

AMENDMENTS TO THE CLAIMS

Claim 1 (original): An optical pickup comprising:
a light source that is provided for generating a laser light;
an objective lens that condenses the laser light to form a light spot for irradiating an optical disk formed of a substrate and having a pair of major surfaces spaced from each other by a thickness of the substrate and a recording face interposed between the major surfaces; and
an actuator that is provided for moving the objective lens in a direction of the thickness of the optical disk within a total movable range so as to focus the light spot on either one of the recording face and the major surface, wherein
the total movable range of the objective lens is set to be equal to or more than a sum of an allowance range and an additional range, the allowance range being set to allow the objective lens to keep a constant distance between the objective lens and the recording face even when a level of the optical disk varies in the direction of the thickness, the additional range being set by dividing a gap between the major surface and the recording face of the optical disk by an absolute refraction index of the substrate of the optical disk.

Claim 2 (original): The optical pickup according to claim 1, wherein the actuator can switch the objective lens between a first base point and a second base point within the total movable range, such that the objective lens can selectively move around the first base point within the allowance range to allow the light spot to follow the recording face or move around the second base point within the allowance range to allow the light spot to follow the major surface.

Claim 3 (original): The optical pickup according to claim 2, wherein the actuator moves the objective lens such that a first movable range of the objective lens extending from the first base point in an inward direction toward the optical disk is set comparable to a second movable range of the objective lens extending from the second base point in an outward direction opposite to the optical disk.

Claim 4 (original): An apparatus for recording information in an optical disk formed of a substrate and having a pair of major surfaces spaced from each other by a thickness of the substrate and a recording face interposed between the major surfaces, the apparatus comprising:

an optical pickup comprising a light source for generating a laser light, an objective lens that condenses the laser light to form a light spot for irradiating the optical disk, and an actuator for moving the objective lens in a direction of the thickness of the optical disk within a total movable range so as to apply the light spot on either of the recording face and the major surface, the actuator being capable of switching the objective lens between a first base point and a second base point within the total movable range, which is set equal to or more than a sum of an allowance range and an additional range, the allowance range being set to allow the objective lens to keep a constant distance between the objective lens and the recording face even when a level of the optical disk varies in the direction of the thickness, the additional range being set by dividing a gap between the major surface and the recording face of the optical disk by an absolute refraction index of the substrate of the optical disk;

a focusing servo section that can servo-control the actuator to move the objective lens around the first base point within the allowance range to focus the light spot on the recording face, and can servo-control the actuator to move the objective lens around the second base point within the allowance range to focus the light spot on the major surface;

an input section that designates one of the recording face and the major surface as a target of recording information; and

a control section being operative when the recording face is designated for instructing the focusing servo section to focus the light spot on the recording face based on the first base point to thereby record the information in the recording face, and being operative when the major surface is designated for instructing the focusing servo section to focus the light spot on the major surface based on the second base point to thereby record the information in the major surface.

Claim 5 (original): The apparatus according to claim 4, wherein the control section operates when the input section designates one of the major surfaces as a label face of the optical disk for instructing the pickup to record information such a manner as to form an visual image on the label face.

Claim 6 (original): A method of recording information by an optical pickup in an optical disk formed of a substrate and having a pair of major surfaces spaced from each other by a thickness of the substrate and a recording face interposed between the major surfaces, the optical pickup having a light source for generating a laser light, an objective lens that condenses the laser light to form a light spot for irradiating the optical disk, and an actuator for moving the objective lens in a direction of the thickness of the optical disk within a total movable range so as to apply the light spot on either one of the recording face and the major surface, the actuator being capable of switching the objective lens between a first base point and a second base point within the total movable range, which is set equal to or more than a sum of an allowance range and an additional range, the allowance range being set to allow the objective lens to keep a constant distance between the objective lens and the recording face even when a level of the optical disk varies in the direction of the thickness, the additional range being set by dividing a gap between the major surface and the recording face of the optical disk by an absolute refraction index of the substrate of the optical disk, the method comprising the steps of:

designating one of the recording face and the major surface as a target of recording information;

servo-controlling the actuator when the recording face is designated to move the objective lens around the first base point within the allowance range to focus the light spot on the recording face to thereby record the information in the recording face; and

servo-controlling the actuator when the major surface is designated to move the objective lens around the second base point within the allowance range to focus the light spot on the major surface to thereby record the information in the major surface.

Claim 7 (original): A program for use in an optical recording apparatus having a processor and an optical pickup for recording information in an optical disk formed of a substrate and having a pair of major surfaces spaced from each other by a thickness of the substrate and a recording face interposed between the major surfaces, the optical pickup having a light source for generating a laser light, an objective lens that condenses the laser light to form a light spot for irradiating the optical disk, and an actuator for moving the objective lens in a direction of the thickness of the optical disk within a total movable range so as to apply the light spot on either one of the recording face and the major surface, the actuator being capable of switching the objective lens between a first base point and a second base point within the total movable range, which is set equal to or more than a sum of an allowance range and an additional range, the allowance range being set to allow the objective lens to keep a constant distance between the objective lens and the recording face even when a level of the optical disk varies in the direction of the thickness, the additional range being set by dividing a gap between the major surface and the recording face of the optical disk by an absolute refraction index of the substrate of the optical disk, the program being executable by the processor for causing the optical recording apparatus to perform a method comprising the steps of:

designating one of the recording face and the major surface as a target of recording information;

servo-controlling the actuator when the recording face is designated to move the objective lens around the first base point within the allowance range to focus the light spot on the recording face to thereby record the information in the recording face; and

servo-controlling the actuator when the major surface is designated to move the objective lens around the second base point within the allowance range to focus the light spot on the major surface to thereby record the information in the major surface.

Claim 8 (new): An optical pickup for irradiating an optical disk, the optical disk having a substrate surface as a first surface thereof, a label surface as a second surfaces thereof, and a recording face between the substrate surface and the label surface, the optical disk having a thickness between the substrate surface and the label surface, the optical pickup comprising:

- a light source that is provided for generating a laser light;
- an objective lens that condenses the laser light to form a light spot for irradiating the optical disk; and

- an actuator that is provided for moving the objective lens in a direction of the thickness of the optical disk within a total movable range so as to focus the light spot on either one of the recording face and the label surface, wherein

- the total movable range of the objective lens is set to be equal to or more than a sum of an allowance range and an additional range, the allowance range being set to allow the objective lens to keep a constant distance between the objective lens and the recording face when a level of the optical disk varies in the direction of the thickness, the additional range being set by dividing a gap between the substrate surface and the recording face of the optical disk by an absolute refraction index of the substrate of the optical disk.

Claim 9 (new): An apparatus for recording data and a visible image on an optical disk having at least a substrate surface, a label surface opposite to the substrate surface, a recording face interposed between the substrate surface and the label surface, and a reflection layer disposed under the recording face, the recording face being irradiated by a laser light through the substrate surface to record and reproduce data, the apparatus comprising:

an optical pickup having an objective lens for irradiating the laser light to the optical disk through the objective lens;

a feed means for moving the optical pickup in a radial direction of the optical disk;

a spindle motor for rotationally driving the optical disk; and

a host computer for controlling the recording of the data and the visible image, wherein the substrate surface of the optical disk faces to the optical pickup when the data is recorded into the recording face,

the label surface of the optical disk faces to the optical pickup when the visible image is recorded into the label surface, and

a distance between the optical lens and the optical disk is differentiated between a first case of recording the data on the recording face and a second case of recording the visible image on the label surface.

Claim 10 (new): The apparatus according to claim 9, further comprising a focus servomechanism for focusing the laser light onto the optical disk by means of the objective lens, such that a gain of the focus servomechanism is switched between the first case of recording the data on the recording face and the second case of recording the visible image on the label surface.

Claim 11 (new): The apparatus according to claim 9, wherein the label surface of the optical disk is coated with a paint for forming the visible image.

Claim 12 (new): The apparatus according to claim 9, wherein the spindle motor rotationally drives the optical disk at a constant angular velocity.

Claim 13 (new): The apparatus according to claim 9, wherein the spindle motor rotationally drives the optical disk at a constant linear velocity.

Claim 14 (new): The apparatus according to claim 9, wherein the spindle motor is provided with a frequency generator for outputting a signal for detecting a rotation angle or rotation speed of the optical disk.

Claim 15 (new): The apparatus according to claim 9, wherein the optical pickup is vibrated in a radial direction of the optical disk during the course of irradiating the laser light onto the rotated optical disk.

Claim 16 (new): The apparatus according to claim 9, wherein the optical pickup is vibrated in a radial direction of the optical disk during the course of irradiating the laser light, with a predetermined amplitude on every varied cycle, such that the laser light is applied to a same circumference of the optical disk a plurality of times.

Claim 17 (new): The apparatus according to claim 9, wherein host computer checks if the label surface of the optical disk is set to face the optical pickup when the optical disk is set.

Claim 18 (new): An optical disk recording apparatus for irradiating a laser light onto an optical disk composed of a substrate having a substrate surface, a label surface opposite to the substrate surface, and a recording face interposed between the substrate surface and the label surface, the optical disk recording apparatus comprising:

a light source that is provided for generating the laser light;

an objective lens that is movable in a direction of a thickness of the substrate of the optical disk within a total movable range and that condenses the laser light to form a light spot for irradiating the optical disk; and

an actuator that can move the objective lens around a first base point for focusing the light spot onto the recording face, and that can move the objective lens around a second base point for focusing the light spot onto the label surface, wherein

the total movable range of the objective lens is set to be equal to or more than a sum of an allowance range and an additional range, the allowance range being set to allow the objective lens to keep a constant distance between the objective lens and the recording face when a level of the optical disk varies in the direction of the thickness, the additional range being added to the allowance range on a side opposite to the optical disk and being set by dividing a gap between the substrate surface and the recording face of the optical disk by an absolute refraction index of the substrate of the optical disk, so that the actuator can switch the objective lens between the first base point and the second base point.